Case History



ME Region - KRONOS™ CW Enables Successful Completion of Challenging Onshore Well

Newpark's KRONOS CW flat-rheology non-aqueous drilling fluid and rigorous onsite engineering supported safe delivery of a demanding 8 3/8-in. carbonate interval despite a constrained drilling window, a well control event, a 10-day unplanned MPD phase and a two-day liner running-tool failure. The interval was completed with no fluids-related NPT and zero recorded net downhole loss.

CHALLENGE	SOLUTION	RESULT
• Shoe integrity initially limited the available pressure window. • A well-control event required 140 pcf kill fluid and an unplanned transition to Managed Pressure Drilling. • Prolonged static periods followed a liner running-tool failure.	• 125 pcf KRONOS CW for drilling; 140-pcf fluid for well control and trips. • MPD managed bottomhole pressure without circulating the 140 pcf system conventionally. • KRONOS CW engineered to maintain fluid and wellbore stability.	• 2,522 ft drilled to 11,669 ft MD in 23 operational days. • Zero fluids-related NPT and no recorded net downhole loss. • Liner run to bottom and cemented as per program; no operational indication of sag or differential sticking.

OVERVIEW

Newpark and the KRONOS CW flat rheology drilling fluid system were selected as the drilling fluid for the 8 3/8-in. interval of a challenging gas production well in the Kingdom of Saudi Arabia. The section was drilled from 9,147 ft to 11,669 ft MD, targeting the Khuff C carbonate reservoir. After reaching section TD and logging, a 7-in. x 4.5-in. tapered liner was planned to be run and cemented.

The job became a field demonstration of system resilience rather than a routine flat-rheology application. The KRONOS CW system had to support rapid density escalation for well control, repeated displacement between 125 pcf (16.7 ppg) drilling fluid and 140 pcf (18.7 ppg) kill/trip fluid, MPD backpressure control, extended static exposure and high solids loading management without a centrifuge.

CHALLENGE

The initial Formation Integrity Test did not reach the planned 150 pcf (20.0 ppg) equivalent mud weight (EMW), with leak-off recorded at approximately 135 pcf (18.0 ppg). After a cement plug and squeeze, the shoe was successfully retested to 150 pcf EMW. The well later developed 5% connection gas at 10,278 ft while drilling with 125 pcf KRONOS CW. Increasing mud weight reduced but did not eliminate the gas. At approximately 11,512 ft, a flow check indicated the well was flowing and the well was shut in and killed with 140 pcf KRONOS CW.

Narrow operating window. A 140-pcf static density was required for well control, but conventional circulation at that density risked Equivalent Circulating Density exceeding fracture pressure at the shoe. The decision was taken to deploy MPD to manage downhole pressure while drilling ahead with a 125 pcf mud weight.

Repeated high-density displacements. The operation required controlled movement between 125 pcf drilling fluid and 140 pcf kill/trip fluid whenever MPD could not be maintained during trips.

Prolonged static exposure. The 140 pcf system remained static for approximately 22 hours during the kill operation and about 26 hours during recovery from the liner running-tool failure, at approximately 5,500 psi maximum bottomhole overbalance.

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Solids-control limitation. No centrifuge was available. Drilled solids content and fluid rheology of the 140 pcf barite-weighted system were managed using a combination of dilution and controlled additions of wetting agent.

SOLUTION

Newpark combined a flexible two-density KRONOS CW fluid strategy with rigorous field engineering, hydraulics surveillance and targeted treatments. The strategy was designed to maintain well control and stable hole conditions without imposing unnecessary circulating density at the shoe.

- Managed 125-pcf KRONOS CW as the drilling fluid and 140-pcf KRONOS CW as the kill/trip fluid. MPD backpressure supplied the remaining equivalent bottomhole pressure while drilling.
- Adjusted Oil/Water Ratio as required, ultimately reaching approximately 89/11 in the 140 pcf system. Increased KRONOCOAT wetting agent concentration as required to improve solids wetting and control fluid rheology.
- Maintained a sized bridging/sealing package in the circulating system using calcium carbonate and granular graphite; pumped sealing pills in accordance with the operator's drilling guidelines.
- Used daily ClearTrack™ hydraulic simulations, frequent fluid testing, shaker monitoring and controlled dilution to manage ECD, hole cleaning and solids loading while maintaining fluid stability.
- Mobilized 10,000-psi Permeability Plugging Test (PPT) capability and verified the 140 pcf fluid at 6,000-psi differential pressure. Field samples were taken and sent to the KSA Technical Center for static sag testing at 280°F.
- During cementing, the onsite engineer worked closely with the Cementing team to ensure continuous displacement after planned pumping procedure became unavailable at short notice.

RESULTS

23	2,522 ft	0	~5,500 psi
Operational days	Interval drilled	Fluids-related NPT	Maximum overbalance

TD was reached with stable circulating behavior, acceptable hole condition and no fluids-related incidents. Average ROP was 35 ft/hr., with a reported peak of approximately 45 ft/hr. instantaneous. Two logging runs were completed without issue. The tapered liner was run successfully to bottom and - after an issue with the mechanical running-tool was resolved - circulation through the liner was re-established and cementing was completed as programmed.

The 140 pcf KRONOS CW remained operationally stable throughout the 22 - 26 hour static periods. The drillstring remained free after the kill, no excessive overpull or torque was reported, and no operational indication of barite sag or differential sticking was observed. Some observation of ballooning was noted during the post-kill circulation, however the final volume accounting confirmed zero recorded downhole losses.

Field Performance Summary

Metric	Recorded performance	Operational significance
Mud weight	125-140 pcf	Two-density drilling, kill and trip strategy
Maximum ECD	~147 pcf	Managed within the retested 150-pcf shoe limit
YP / 6-rpm	14-22 / 8-10	Low-end support with controlled circulating behavior
Electrical stability	580-850 V	Stable emulsion across changing density and OWR
HTHP fluid loss	1.2-1.8 mL/30 min	250°F and 500-psi differential
PPT spurt / total	0.1/2.2 to 1.4/2.8 mL	300°F; 5,000-6,000-psi differential
Static exposure	~22 hr / ~26 hr	No operational sag or differential-sticking indication

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LABORATORY VALIDATION OF STATIC SUSPENSION

Newpark's KSA Technical Center of Excellence tested two actual field samples under static aging at 280°F. Both samples remained within the 0.50-0.53 sag-factor window through 48 hours, independently supporting the suspension performance observed during the well's approximately 22- to 26-hour static events. The 24- and 48-hour results are presented because they encompass the field exposure period.

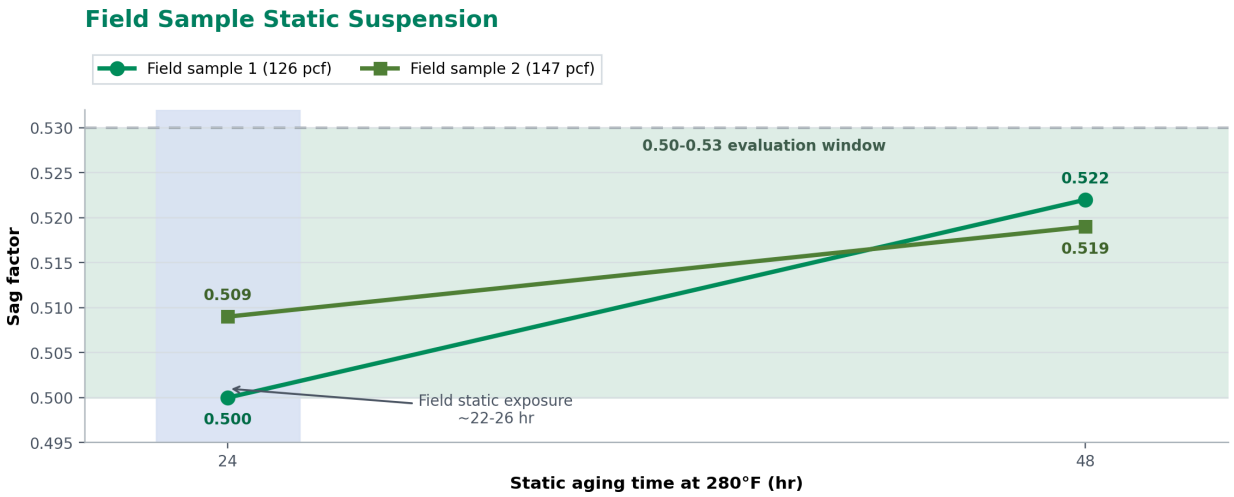


Figure 1. static sag testing at 280°F on KRONOS CW active mud and logging pill samples.

CONCLUSION

Operations while drilling this 8 3/8 in. section demonstrates how KRONOS CW can support a high-density, high-overbalance application when operational requirements change unexpectedly. The fluid remained manageable across the 125 – 140 pcf density range, supported MPD and well-control operations, tolerated high solids without a centrifuge, and maintained a stable fluid column through prolonged static periods.

Combined with proactive onsite engineering, this enabled the operator to complete drilling, logging, liner placement and cementing with zero fluids-related NPT.